

Abstract

The flow of non-Newtonian fluids through microchannels often shows slip velocity near microchannel walls. This can be seen for hydrodynamic, fully developed, steady, laminar flow of pseudoplastic and dilatant fluids. A numerical analysis is done for fully developed, steady laminar flow of non-Newtonian fluids by the help of power law model. Governing equations were analysed and applied in the numerical analysis along with slip boundary condition at walls. Circular cross section of the microchannel is considered for analysis. Velocity fields along with other slip flow parameters like slip co-efficient, slip length, friction factor have been compared for pseudoplastic and dilatant fluids.

Further, this analysis is extended by considering the flow of a non-Newtonian fluids having electrical conductivity through circular microchannel which is under the influence of externally applied magnetic field. For the purpose, fluid properties of Xanthan solution in formic acid were considered for the analysis. Velocity fields containing slip velocity and centreline velocities were observed under the influence of magnetic field which was in the range of 0.1 T to 0.4 T. The effects of slip co-efficient and magnetic fields were observed. The influence of Hartmann number was also observed on the slip velocities and centreline velocities. A comparison of friction factor has been done along the length of the microchannel to understand the effect of slip co-efficient on the magnetohydrodynamics (MHD) induced slip flow.